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Aggradation and Degradation Aspects of the Missouri River Main Stem Dams

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AGGRADATION AND DEGRADATION
ASPECTS OF THE MISSOURI RIVER
MAIN STEM DAMS

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INTRODUCTION

The U.S. Army Corps of Engineers, Missouri River Division, has constructed six large multi-purpose dams in tandem along the main stem of the upper Missouri River for the purposes of flood control, power production, irrigation, water supply, augmentation of river discharges for navigation and water quality, recreation, and fish and wildlife benefits. These dams now intercept the sediment from one of the largest and most productive sediment producing regions in the continental United States. Sediment measurement records indicate that an average of 1.35×10^8 tons of sediment per year was transported by the river as suspended load prior to construction of the dams. The amount of sediment passing through the system has since been reduced to virtually zero, which means that all of the incoming sediment load is now being deposited within the six-dam river-reservoir system. This has had a far-reaching influence, not only within the individual reservoir projects themselves, but also on the open river reaches between the projects and downstream from the lowest dam. Our experience to date, and the impacts of the reservoir effects, are discussed below.

SUMMARY

The U.S. Army Corps of Engineers has constructed six large multi-purpose dams in tandem along the main stem of the upper Missouri River. This system completely controls the sediment from one of the largest and most productive sediment producing areas in the continental United States.

The combined impact of sediment entrapment and river flow regulation resulting from construction of the dams has had a significant influence not only on the individual projects, but also on the open river reaches downstream. Sediment deltas are forming in the upstream ends of each reservoir, resulting not only in the loss of reservoir storage capacity, but also in higher water surface elevations for flows entering the backwater reaches of the pools. The downstream growth of sediment deposits has not as yet progressed to the dams and powerhouses; therefore, no adverse impacts on the hydraulic machinery have been noted. Water released through the dams is influencing the downstream channel and has altered the natural erosion and deposition processes, resulting in changes in the downstream channel characteristics for many kilometers downstream.

The paper includes a review of pre-project sedimentation estimates and comparisons with actual experience to date, accompanied by a review of other sediment-related phenomena and associated problems. Sedimentation is viewed from a broad context, and includes upstream aggradation, formation of delta deposits within the reservoirs, channel degradation below the dams, and the influence on bank erosion in the open river reaches downstream from the reservoirs.